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ABSTRACT

Learning to see reality at multiple levels provides instructional leaders with several advantages (e.g., being adaptive and solving problems before they occur, being creative by choosing a different future, and being generative by bringing forth something new). Four distinct levels of reality in systems thinking are: events encountered on a daily basis, patterns of events, systemic structure as the cause behind the events, and shared visions as the guiding force behind the creation of structures. The language of systems thinking involves links and loops as the dynamic thinking tools that provide the visual means to represent patterns of events occurring over time and structures producing those dynamics. Causal loops are stories told using variables and arrows ("links") to depict how one variable influences another. The reinforcing loop situation generally goes into highly amplified growth or decline. The balancing loop, which is similar to naturally occurring growth, is often found in situations that appear to be self-correcting and self-regulating. Systems archetypes include: drifting goals, escalation, fixes that fail, growth and underinvestment, limits to success, shifting the burden, success to the successful, and tragedy of the commons. (Most of this document consists of graphics of loops and links, descriptions of archetypes in "at a glance" format, and case examples that involve various archetypes.) (SM)

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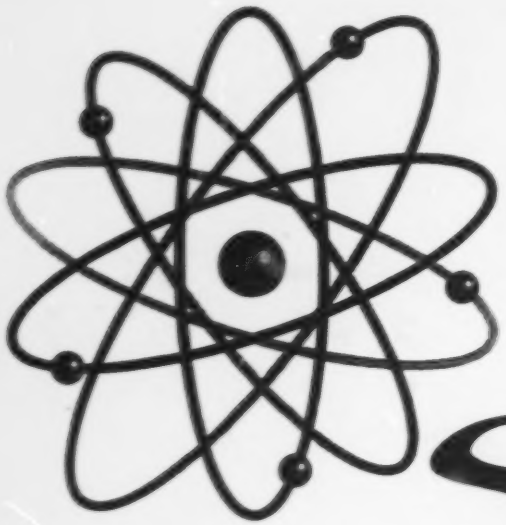

The Instructional Leader's Primer in Systems Thinking

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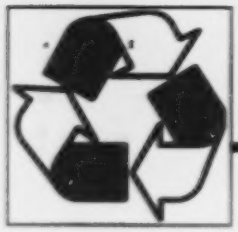


Why Do I Need Systems Thinking

There is a Chinese curse, "May you live in interesting times," and it has never been more true than in our day and age. We are living in a time of transition between ages. The Machine Age and the industrial society it produced is behind us and before us lies the Information Age. Living in the transition between the two ages is difficult and challenging.

"The old tried and true ways are just not working anymore. It seems that when we solve one problem it comes back in a different form, and what is more, five more problems pop up to take its place" say Maynard and Mehrtens in The Fourth Wave . How are we to live and lead others in such a world?

Systems thinking represents one approach to more successful thinking and acting in a world in transition. It is like learning to see the world through a wide-angle rather than telephoto lens. It is a new language, that when learned can enable us to see the web of tightly interconnected circular relationships surrounding many of the problems we face today. In a world we are discovering to be increasingly complex and interdependent systems thinking is "a language for communicating about complexities and interdepencencies"(Goodman, 1994).

Systems thinking can be a useful tool for the instructional leader for the following reasons:

1. It is a circular language focusing on closed interdependencies which more closely resembles the real world.

2.It is a visual language with causal loop diagrams, behavior-over time diagrams, systems archetypes, and structure diagrams. These visual formats of complex interdependent issues help clarify tough problems by visually protraying the key elements involved.

3. The rules of this visual language greatly reduce the ambiguities and miscommunications so common in complex problem solving.

4. It surfaces the "explicitness" of mental models. The visual nature of the language allows for the translation of "war stories" and individual perceptions into black and white pictures that can reveal subtle differences of viewpoint.

5. It allows examination and inquiry. The diagrams can produce collective understanding of a complex problem.

6. It is consistent with reality in that it looks at wholes, rather than parts. Reality is often made up of complex interconnections of circular causality which are difficult to comprehend with a linear, mechanistic world-view. To learn the language is to also learn to see the world anew and afresh from a totally new and exciting perspective.

Viewing Reality at Multiple Levels

In the Machine Age, which emphasized parts and things, reality was mostly about "events." Almost everyone who leads any kind of an organization today knows the futility of focusing on events. Reactive organizations are those with an event focus. No one has to explain to today's instructional leader how difficult and taxing such organizations are to lead. The first step in moving beyond being a reactive organization is to learn to see causal factors behind the events-to see the whole picture.

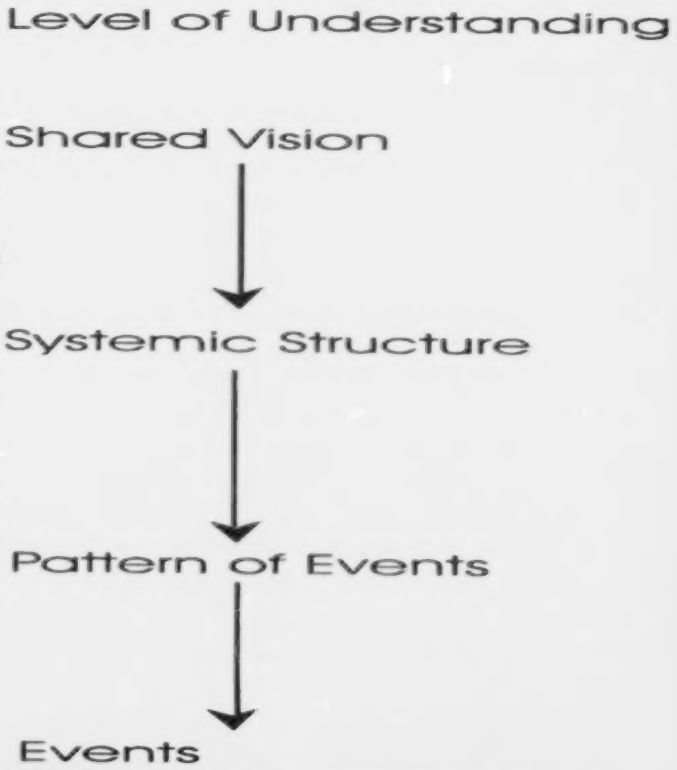
There are four distinct levels of reality in a systems thinking perspective. Events are the things we encounter on a day-to-day basis. Patterns are the accumulated memories of events which can reveal recurring patterns. Systemic structure are the causes behind the events and shared visions are the guiding force behind the creation of the structures.

To learn to see reality at multiple levels provides the instructional leader a number of significant advantages. First, we are able to be *adaptive* and solve problems before they occur. Second, we can be *creative* by choosing a different future rather than allowing future events to shape our future. Third, we can be *generative* by bringing something into being that did not exist before.

The instructional leader who is most effective at systemic thinking is one who able to consider all levels of reality simultaneously. There is a distinct danger, clearly embodied in the reactive organization, of operating at one level and excluding others. As one moves up the levels the ability to influence the future increases.

Therefore, one might say the ability to see all levels of reality together is important, but success and creativity depend on the ability to see where the highest leverage exists.

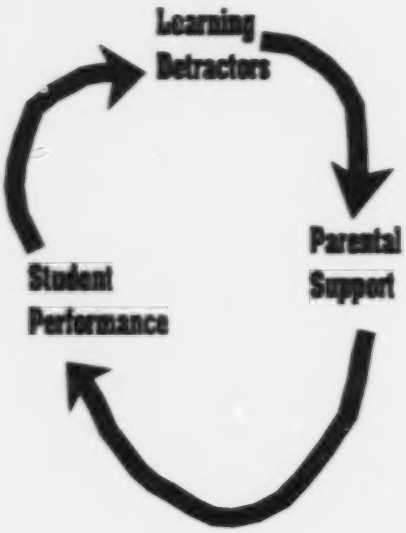
The basic value to instructional leaders of seeing the multiple levels of reality, according to Michael Goodman is,"the importance of recognizing the level at which you are operating and evaluating whether or not it provides the highest leverage for that situation." For example, the instructional leader who focuses on instuctional design techniques at the exclusion of redesigning the structure of the school day has not identified the leverage point for impacting future outcomes for that school.



The Language of Systems Thinking: Links & Loops

Links and loops are the dynamic thinking tools which provide the visual means to represent the patterns of events which occur over time and the structures which are producing those dynamics. Some are intimidated by causal loop diagrams, but need not be since the skill can be acquired with just a little effort. When one learns to tell the story of loops and links, the ability to see the world from a new perspective is acquired which enriches and enhances us as leaders.

Causal loops are little more than a stories which are told using the variables and arrows ("links") to depict how one variable influences another, making a situation better or worse. For example, a story about student performance:



How to Tell the Story from a Loop

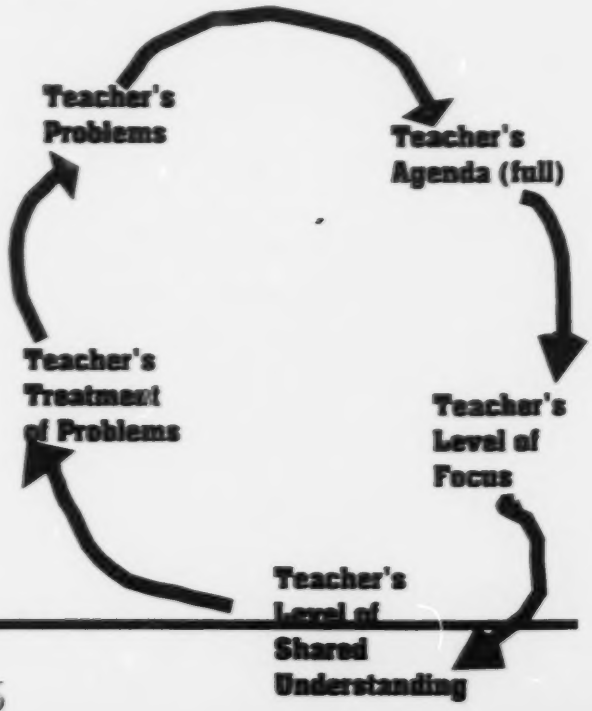
1. Start anywhere that makes sense to you. Pick the element of most concern- *students performance* increasing. Now is not the time to explain why this is happening-yet.

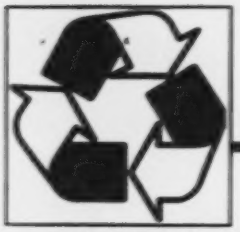
2. Any element may increase or decrease at various times. What has the element you chose been doing at this moment?

3. Describe the influence this movement has on the next element. As *student performance increases, learning detractors decrease, and parental support increases.*

4. Continue the story back to your starting place. Use words that describe the causal relationships: *this causes, this influences and results in etc..*

5. Try not to tell the story in a mechanistic fashion.

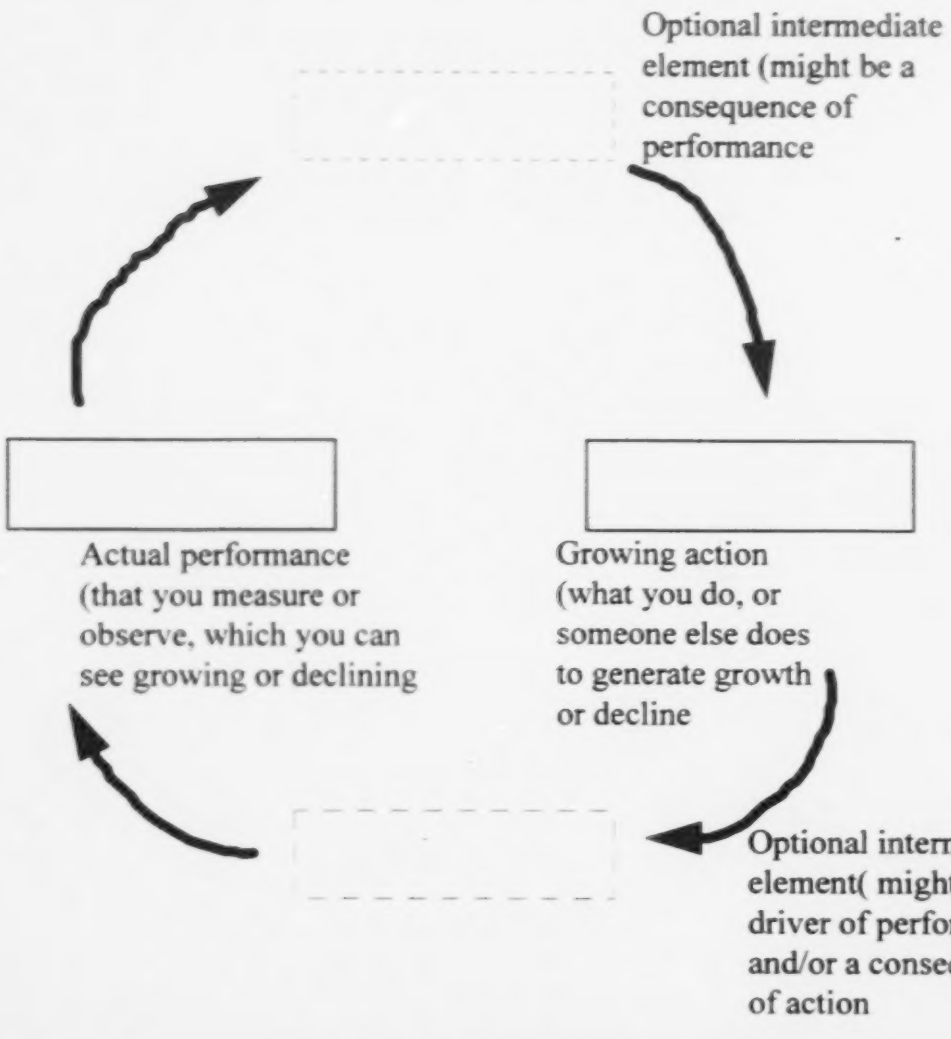




The Reinforcing Loop

Reinforcing loops are like snowballs rolling down hill. The reinforcing loop situation generally goes into highly amplified growth or decline. It can be a vicious or virtuous cycle according to the situation. A reinforcing loop is by definition incomplete. In a reinforcing loop small change builds upon itself.

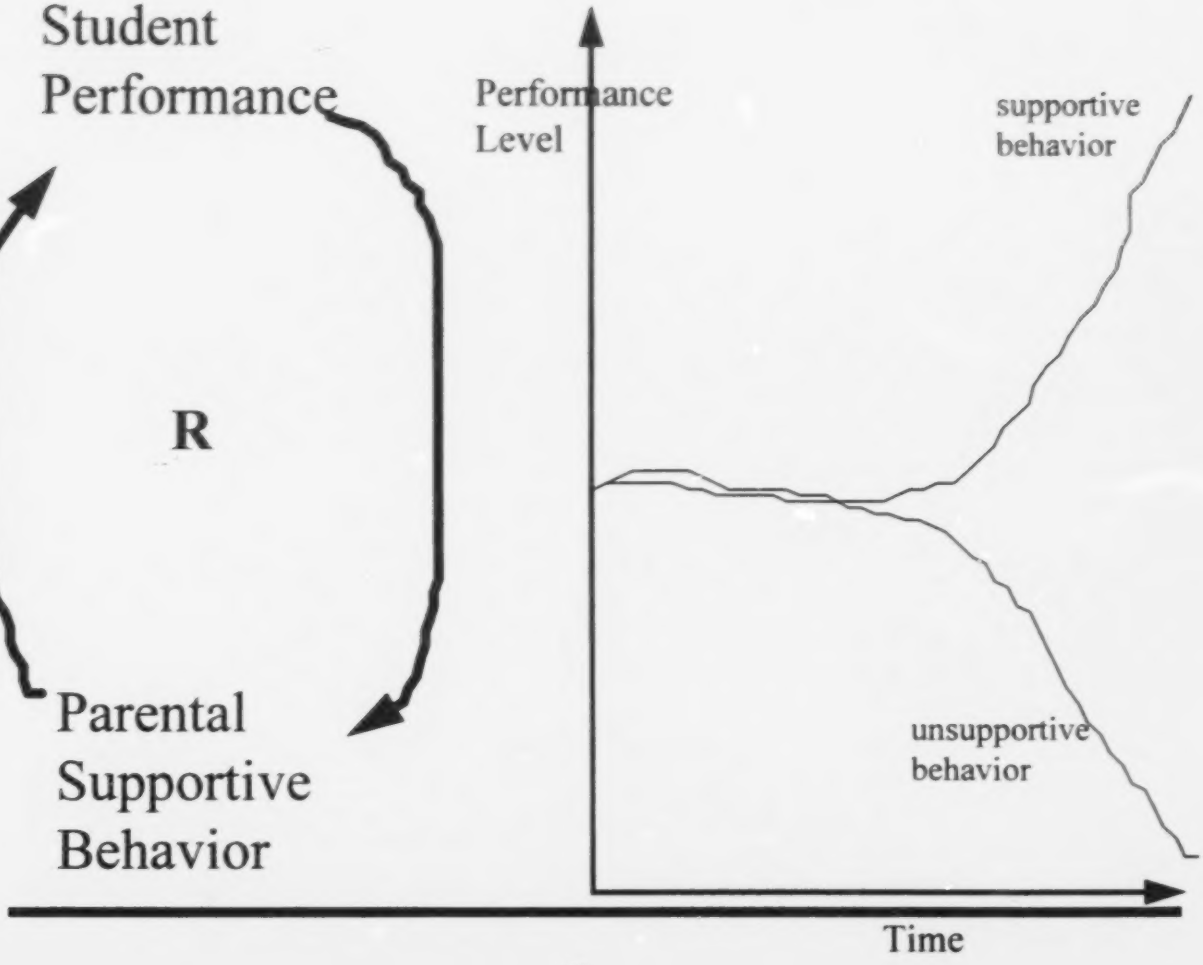
Examples of reinforcing loops might be student performance and the supportive behavior of the principal or influential teachers. Another might be a particular student infraction like pitching quarters in the restroom and peer pressure on others to do the same thing. A "squealing" microphone is another reinforcing loop, demonstrating how the sound goes through several cycles of being amphlified.

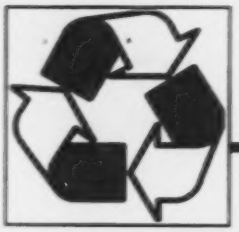

Optional intermediate element (might be a consequence of performance
Growing action (what you do, or someone else does to generate growth or decline
Optional intermediate element(might be a driver of performance and/or a consequence of action
Actual performance (that you measure or observe, which you can see growing or declining

Student Performance /Parental Support Reinforcing Loop

Structure

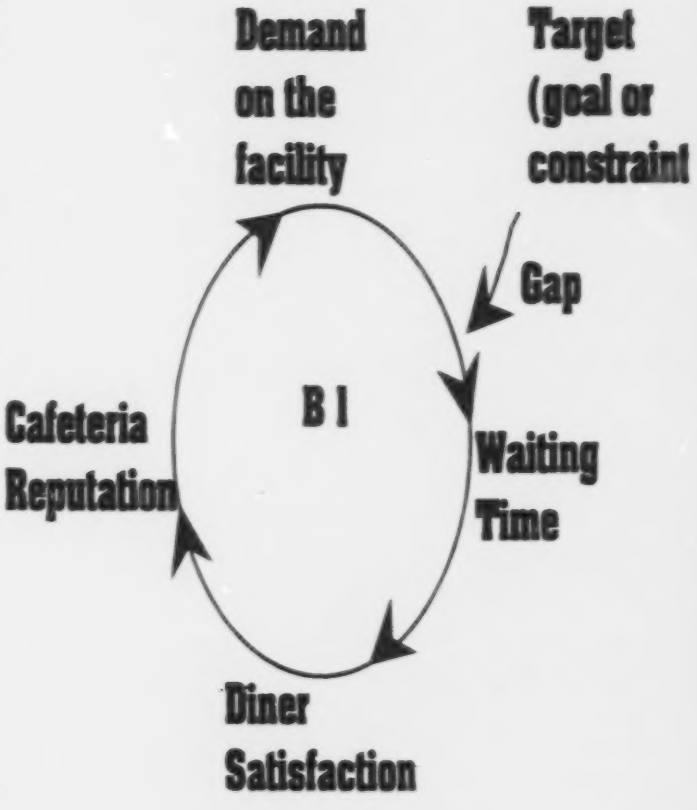
Behavior Over Time





Balancing Loops: Pushing Stability, Resistance, and Limits

The balancing loop is how "Mother Nature" controls growth. For example, if a species begins to increase in population beyond what the "balance of nature" can sustain, then a balancing loop in the form of disease, predators, famine etc. will cause the accelerating growth of the species to be slowed down or stopped entirely. When mankind interrupts this "balance of nature" there can be catastrophic consequences, as witnessed by recent U.S. forest fires so massive and intense they were beyond being controlled. Previous years without some burning created forests so dense that once fires began, they were impossible to control. "Mother Nature" uses balancing loops to fix problems, maintain stability, and achieve equilibrium.

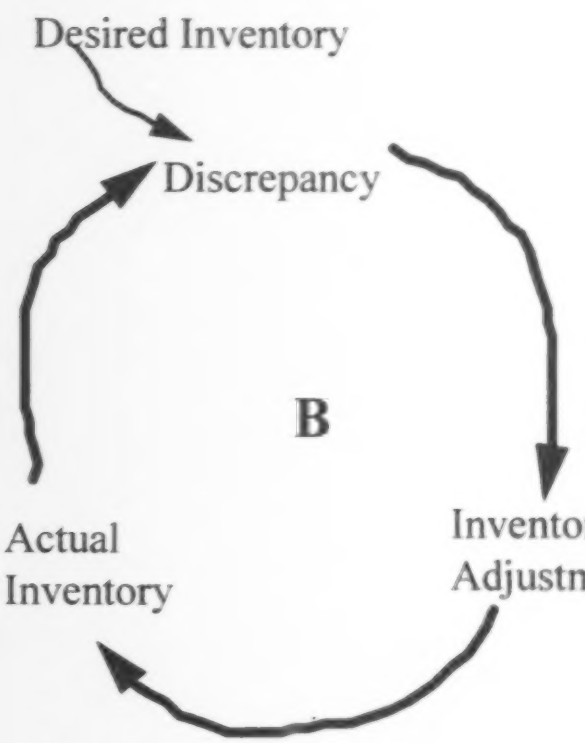


Balancing loops are often found in situations which seem to be self-correcting and self-regulating, whether the participants like it or not. Our survival depends on the many balancing processes which regulate the earth, the climate and our bodies.

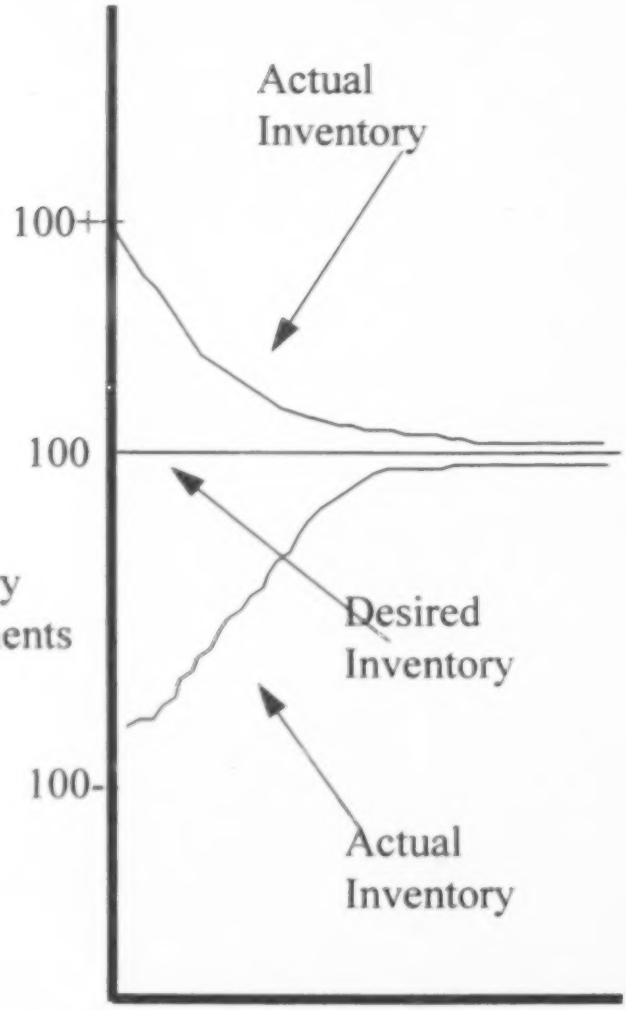
"Balancing processes are always bound to a target-a constraint or total which is often implicitly set by the forces of the system. Whenever current reality doesn't match the balancing loop's target, the resulting gap generates a kind of pressure which the system cannot ignore. The greater the gap, the greater the pressure. It's as if the system itself has a single-minded awareness of 'how things ought to be' and will do everything in its power to return to that state. Until ;you recognize the gap, and identify the goal or constraint which drives it, you won't understand the behavior of the balancing loop."
The Fifth Discipline Fieldbook

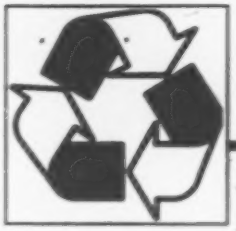
Copy Machine
Inventory Control Balancing Loop

Structure



Behavior Over Time





Balancing Loop Template

Actual performance
(that you measure or
observe; often a problem statement

desired performance
either known or
unknown to you

Target

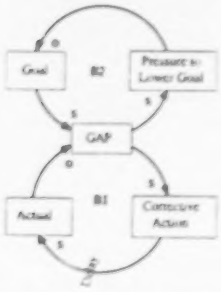
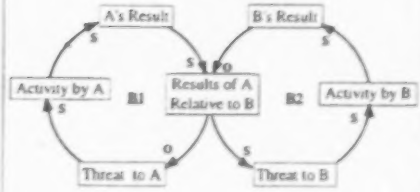
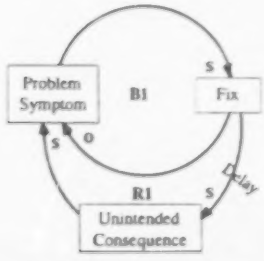
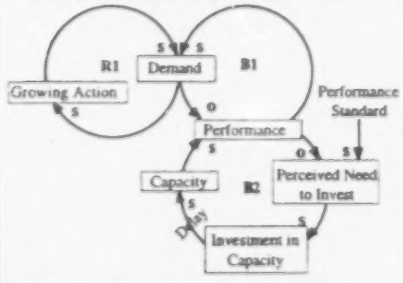
Gap

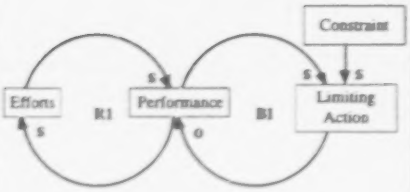
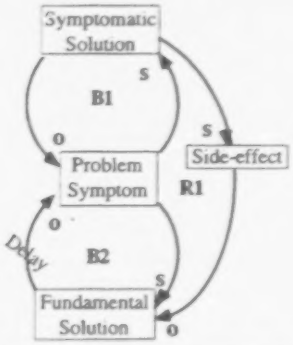
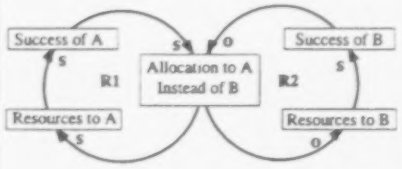
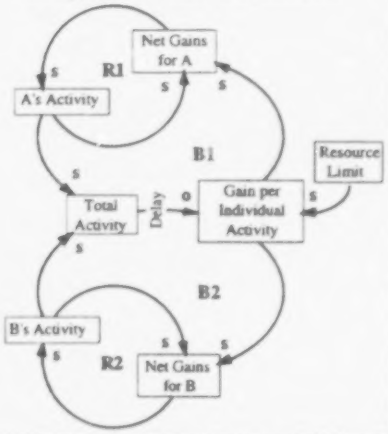
(discrepancy between
desired and actual
performance, either
visible to you as a
shortfall, evident as a
need, or felt as a
pressure

Optional intermediate
element (might be a quick
fix or a driver of performance

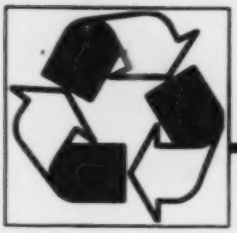
Corrective action
(can be quick fix or
a driver of your performance

Systems Archetypes at a Glance

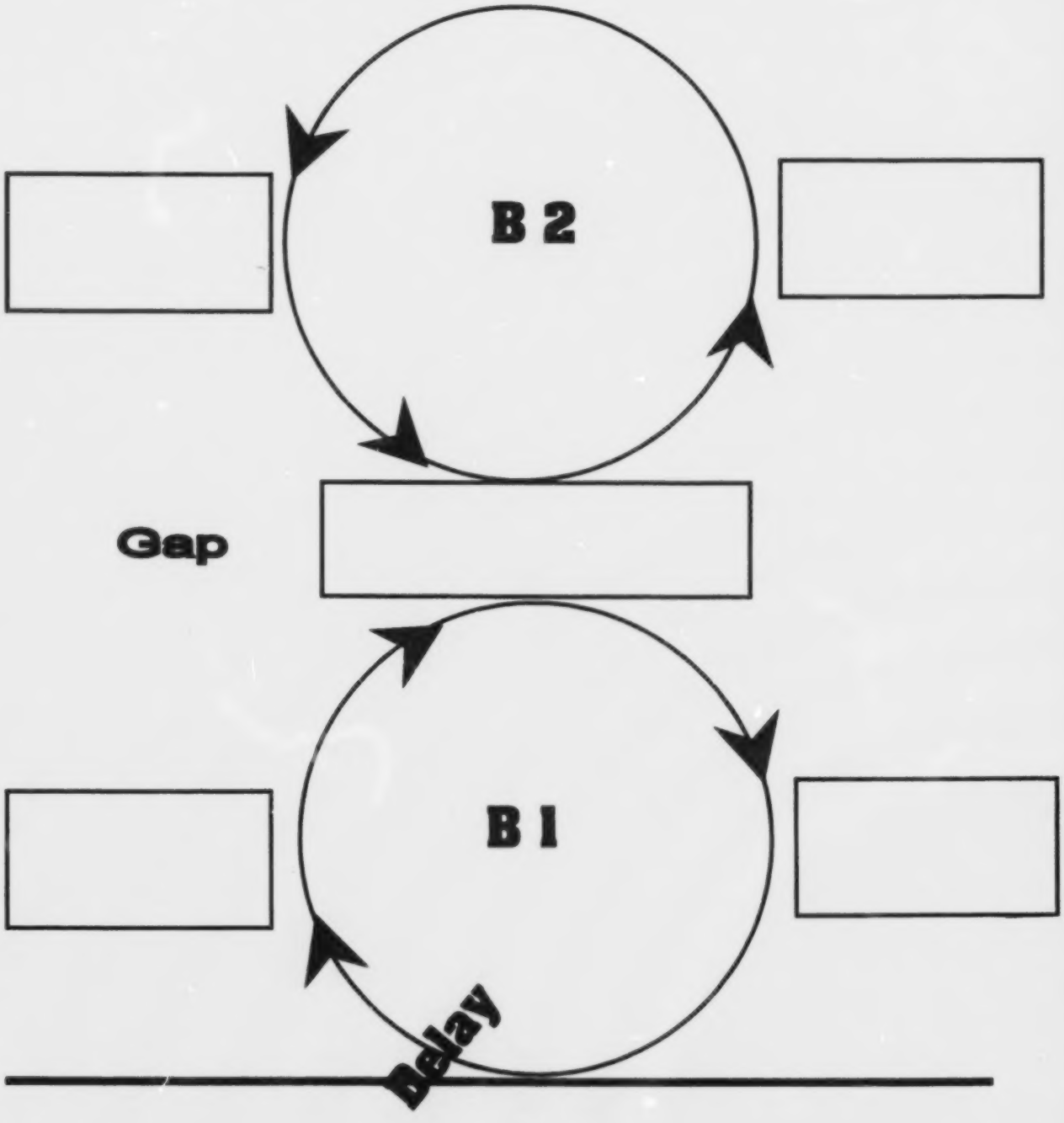
Archetype	Description	Guidelines
Drifting Goals 	In a "Drifting Goals" archetype, a gap between the goal and current reality can be resolved by taking corrective action (B1) or lowering the goal (B2). The critical difference is that lowering the goal immediately closes the gap, whereas corrective actions usually take time. (See *Toolbox*, October 1990).	• Drifting performance figures are usually indicators that the "Drifting Goals" archetype is at work and that real corrective actions are not being taken. • A critical aspect of avoiding a potential "Drifting Goals" scenario is to determine what drives the setting of the goals. • Goals located outside the system will be less susceptible to drifting goals pressures.
Escalation 	In the "Escalation" archetype, one party (A) takes actions that are perceived by the other as a threat. The other party (B) responds in a similar manner, increasing the threat to A and resulting in *more* threatening actions by A. The reinforcing loop is traced out by following the outline of the figure-8 produced by the two balancing loops. (See *Toolbox*, November 1991).	To break an escalation structure, ask the following questions: • What is the relative measure that pits one party against the other and can you change it? • What are the significant delays in the system that may distort the true nature of the threat? • What are the deep-rooted assumptions that lie beneath the actions taken in response to the threat?
Fixes that Fail 	In a "Fixes that Fail" situation, a problem symptom cries out for resolution. A solution is quickly implemented that alleviates the symptom (B1), but the unintended consequences of the "fix" exacerbate the problem (R1). Over time (right), the problem symptom returns to its previous level or becomes worse. (See *Toolbox*, November 1990).	• Breaking a "Fixes that Fail" cycle usually requires two actions: acknowledging that the fix is merely alleviating a symptom, and making a commitment to solve the real problem now. • A two-pronged attack of applying the fix and planning out the fundamental solution will help ensure that you don't get caught in a perpetual cycle of solving yesterdays "solutions."
Growth and Underinvestment 	In a "Growth and Underinvestment" archetype, growth approaches a limit that can be eliminated or pushed into the future if capacity investments are made. Instead, performance standards are lowered to justify underinvestment, leading to lower performance which further justifies underinvestment. (See *Toolbox*, June/July 1992).	• Dig into the assumptions which drive capacity investment decisions. If past performance dominates as a consideration, try to balance that perspective with a fresh look at demand and the factors that drive its growth. • If there is a potential for growth, build capacity in anticipation of future demand.

Archetype	Description	Guidelines
Limits to Success 	In a "Limits to Success" scenario, continued efforts initially lead to improved performance. Over time, however, the system encounters a limit which causes the performance to slow down or even decline (B1), even as efforts continue to rise. (See *Toolbox*, December 1990/January 1991).	• The archetype is most helpful when it is used well in advance of any problems, to see how the cumulative effects of continued success might lead to future problems. • Use the archetype to explore questions such as "What kinds of pressures are building up in the organization as a result of the growth?" • Look for ways to relieve pressures or remove limits *before* an organizational gasket blows.
Shifting the Burden/Addiction 	In a "Shifting the Burden," a problem is "solved" by applying a symptomatic solution (B1) which diverts attention away from more fundamental solutions (R1). (See *Toolbox*, September 1990). In an "Addiction" structure, a "Shifting the Burden" degrades into an addictive pattern in which the side-effect gets so entrenched that it overwhelms the original problem symptom. (See *Toolbox*, April 1992).	• Problem symptoms are usually easier to recognize than the other elements of the structure. • If the side-effect has become the problem, you may be dealing with an "Addiction" structure. • Whether a solution is "symptomatic" or "fundamental" often depends on one's perspective. Explore the problem from differing perspectives in order to come to a more comprehensive understanding of what the fundamental solution may be.
Success to the Successful 	In a "Success to the Successful" archetype, if one person or group (A) is given more resources, it has a higher likelihood of succeeding than B (assuming they are equally capable). The initial success justifies devoting more resources to A than B (R1). As B gets less resources, its success diminishes, further justifying more resource allocations to A (R2). (See *Toolbox*, March 1992).	• Look for reasons why the system was set up to create just one "winner." • Chop off one half of the archetype by focusing efforts and resources on one group, rather than creating a "winner-take-all" competition. • Find ways to make teams collaborators rather than competitors. • Identify goals or objectives that define success at a level higher than the individual players A and B.
Tragedy of the Commons 	In a "Tragedy of the Commons" structure, each person pursues actions which are individually beneficial (R1 and R2). If the amount of activity grows too large for the system to support, however, the "commons" becomes overloaded and everyone experiences diminishing benefits (B1 and B2). (See *Toolbox*, August 1991).	• Effective solutions for a "Tragedy of the Commons" scenario never lie at the individual level. • Ask questions such as: "What are the incentives for individuals to persist in their actions?" "Can the long-term collective loss be made more real and immediate to the individual actors?" • Find ways to reconcile short-term individual rewards with long-term cumulative consequences. A governing body that is chartered with the sustainability of the resource limit can help.

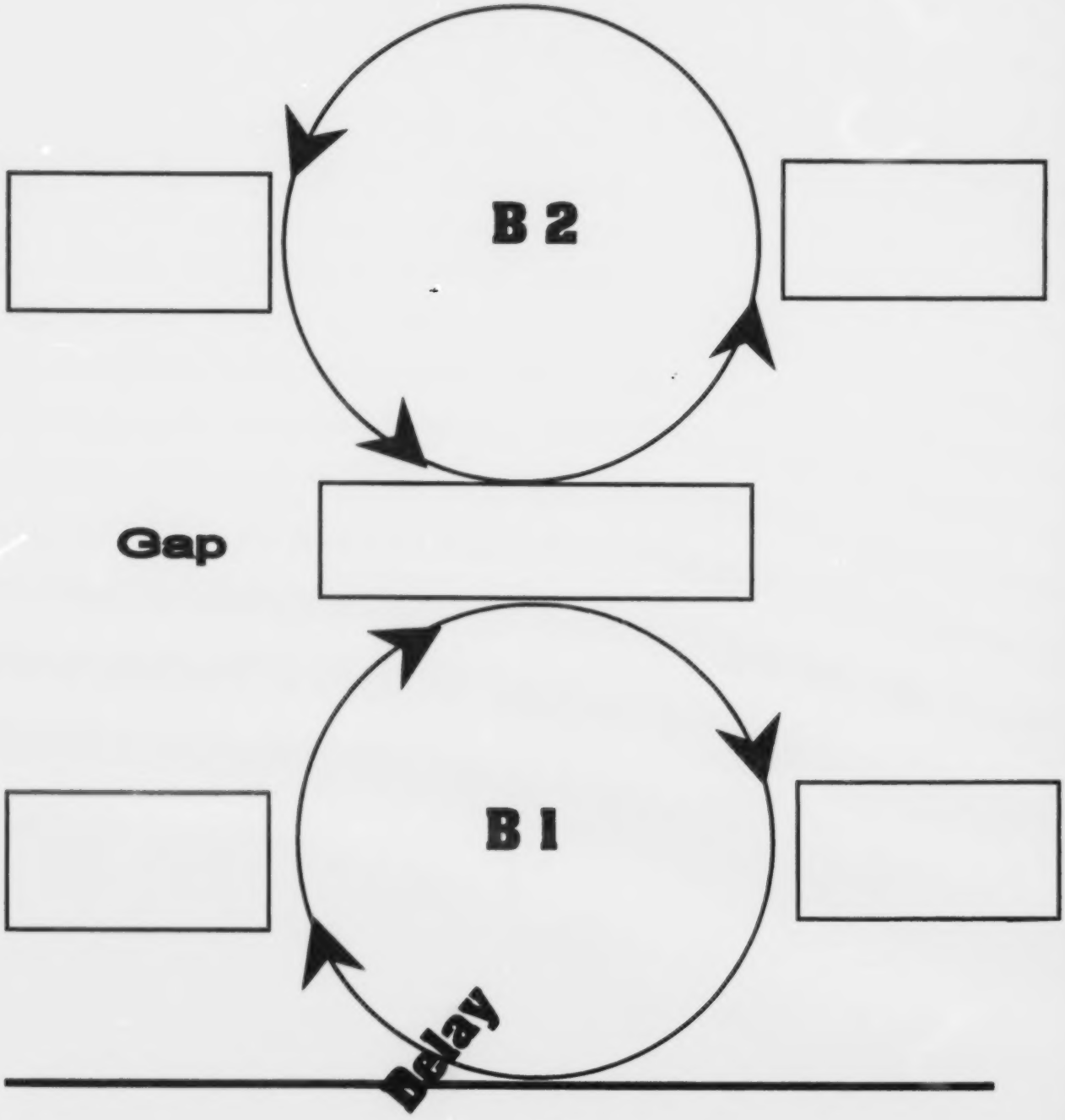
The archetypes are drawn from *The Fifth Discipline* by Peter M. Senge (available from Pegasus Communications).



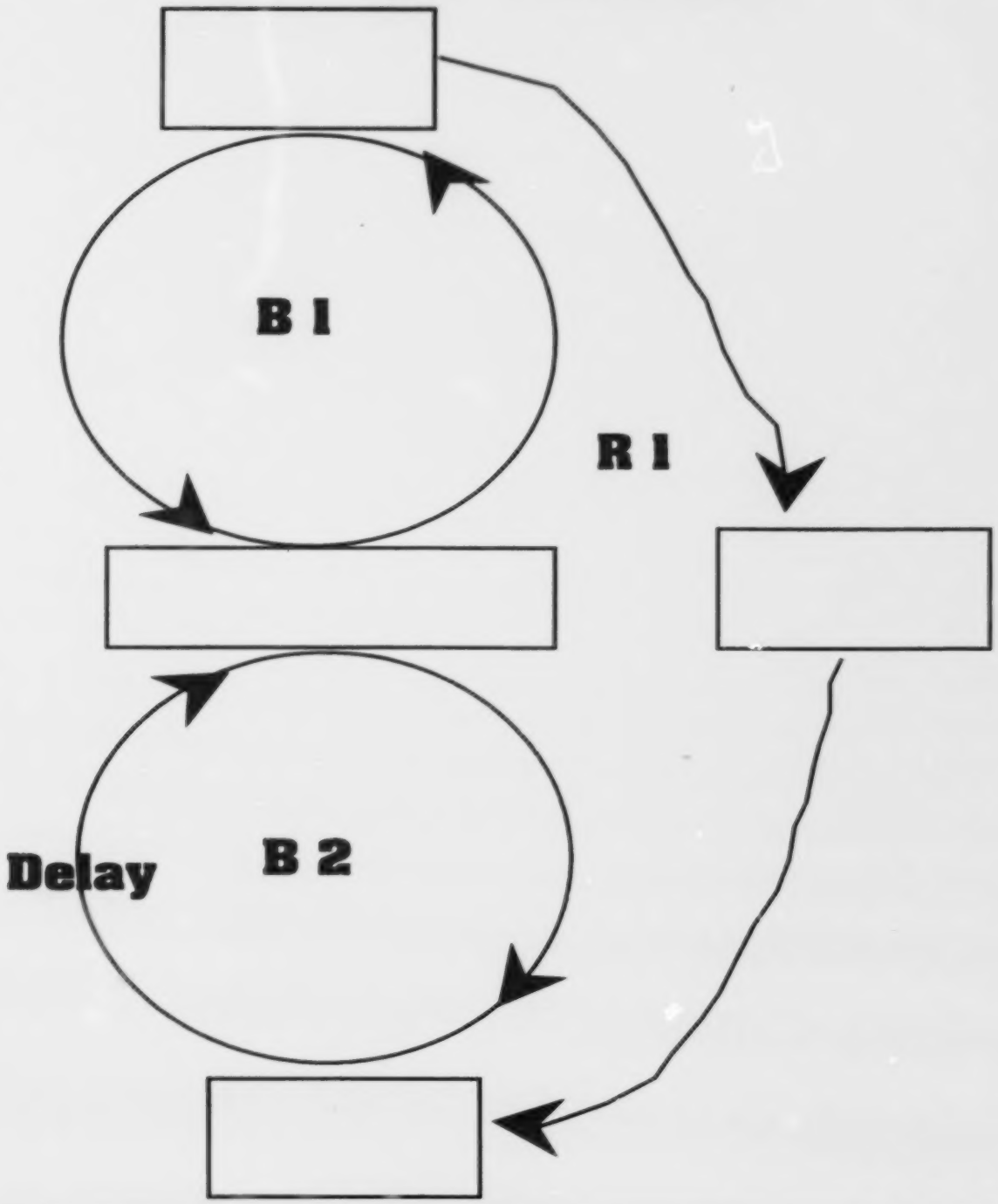
Drifting Goals



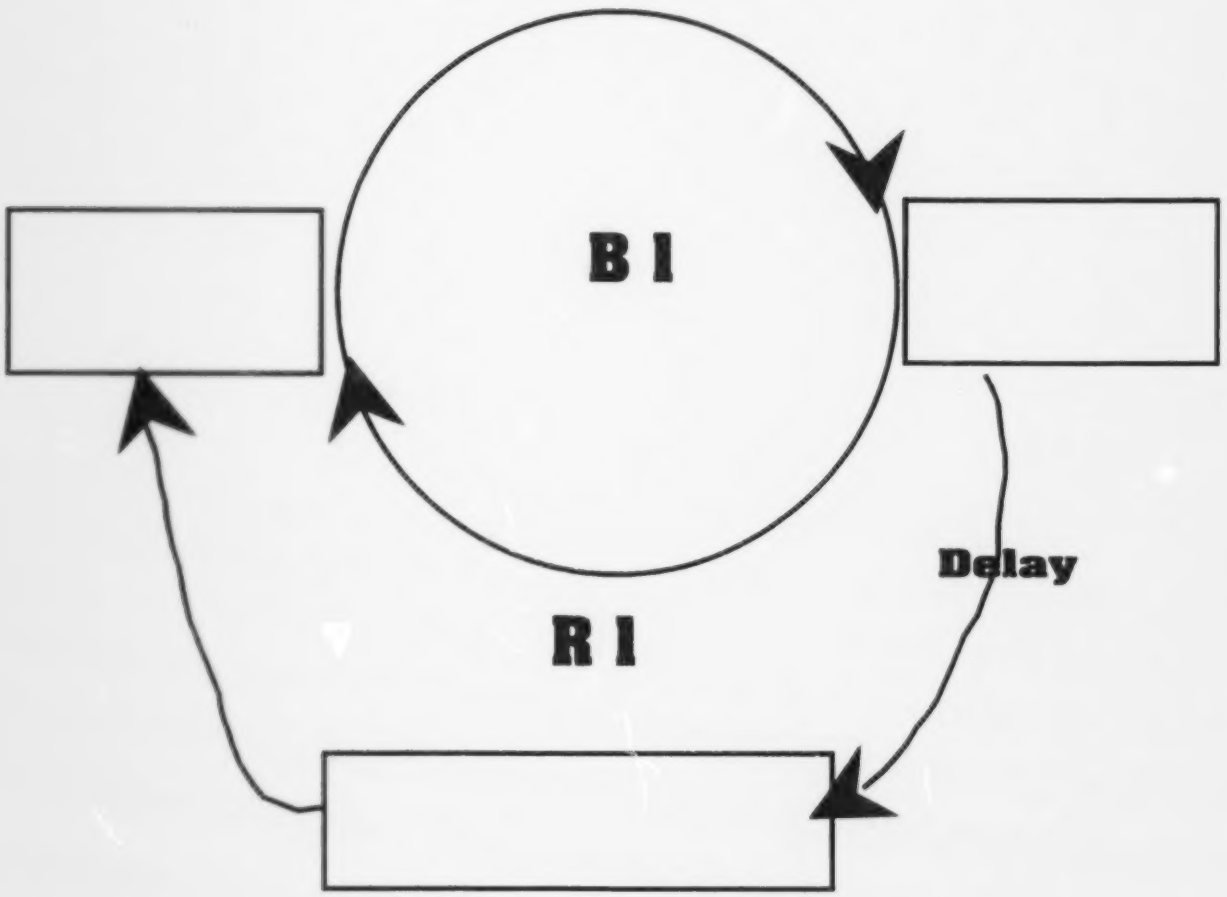
Drifting Goals



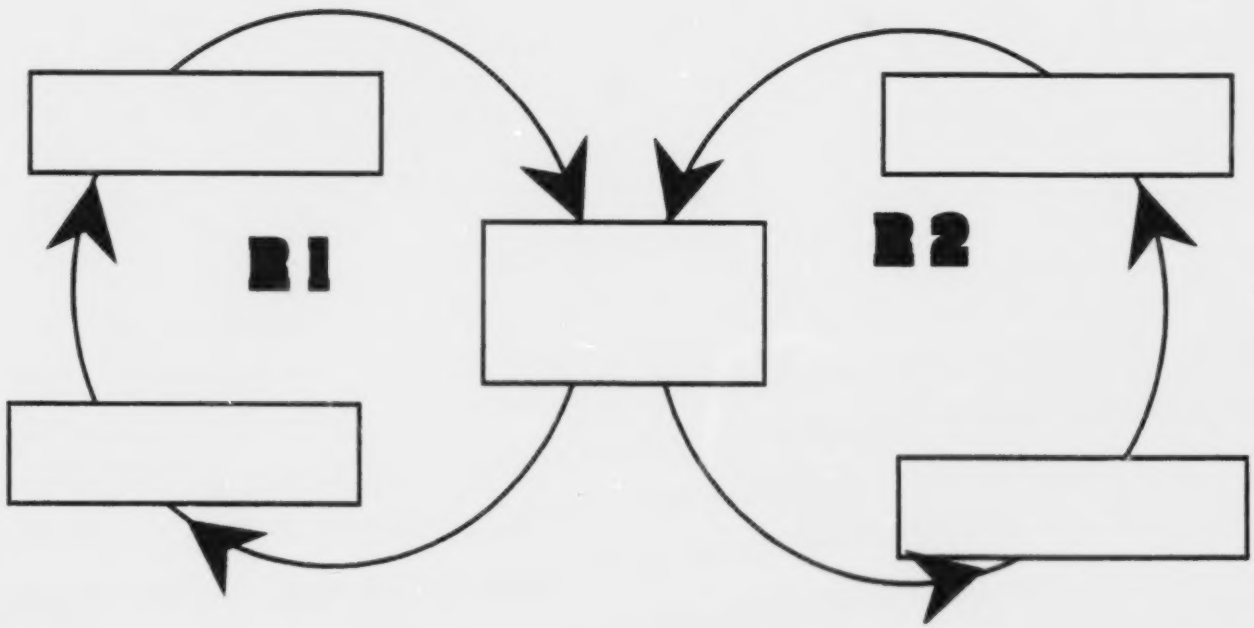
Shifting the Burden



Fixes that Fail

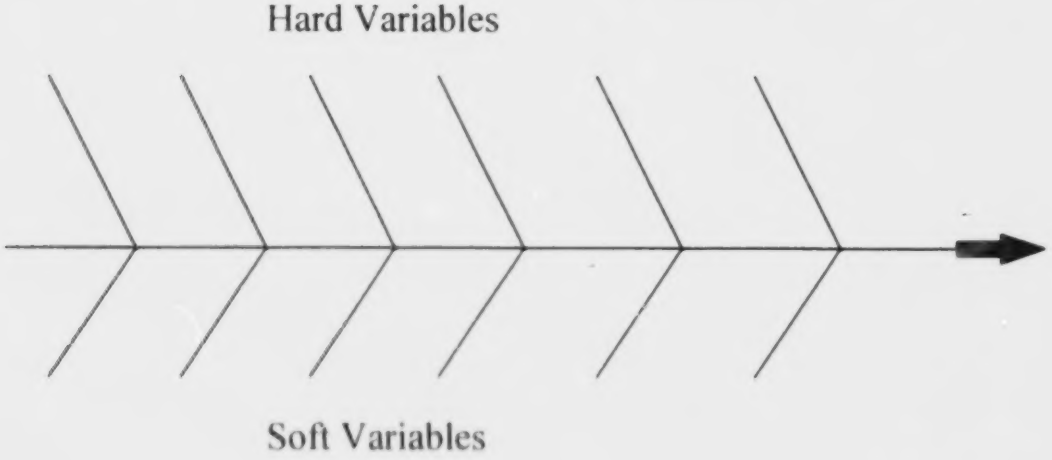


Success to the Successful



Double Q Diagram

A brainstorming tool for capturing free-flowing thoughts in a structured manner and distinguishing between hard and soft variables that affect the issue of interest



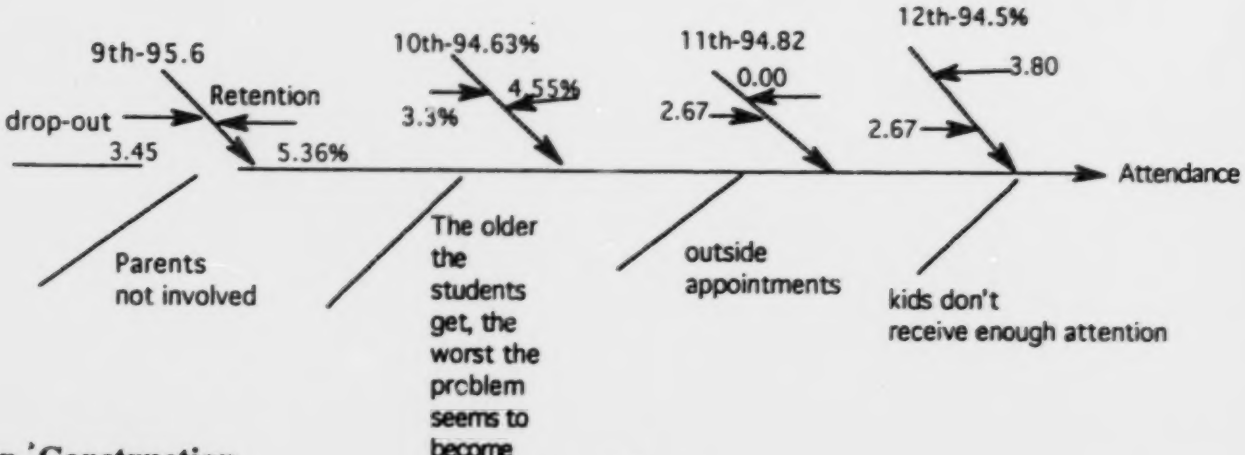
Using the Double Q Diagram with the Transformation Plan

Systems tools and archetypes help you uncover information tht is not immediately obvious. In the process of reviewing the Transformation Plan one of the action steps just didn't seem to address the real problem even though it was a "common sense" action to take in response to the problem. Using the Double Q Diagram I placed drop-out, retention hard and soft data up alongside one another and began to think there might be a connection between the seeming pattern of significant retention rates at grades 9 and 10. At grade 11 there were 0% retentions, but at 12 there were 3.80%.

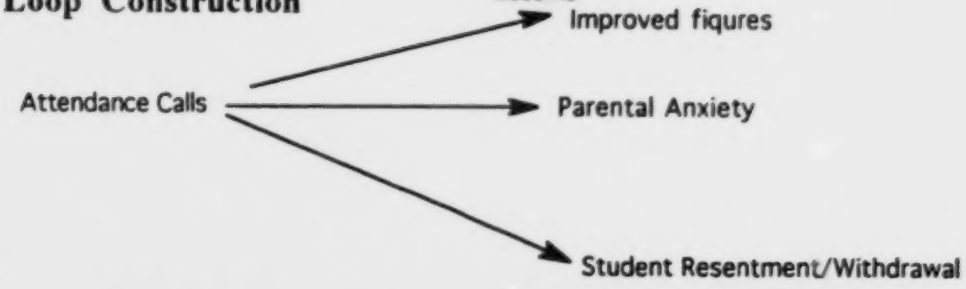
While it appears that the 5.36% retention rate at 9th grade and 4.55% at 10th may have resulted in a slightly lower one at the 11th, it is not permanent if these figures are consistent over a period of time. It looks as if there may be a correlation between the three sets of figures. If that is true, then the solution has not been identified by the committee in its' action plan. A solution such as calling parents does not seem to address the real problem.

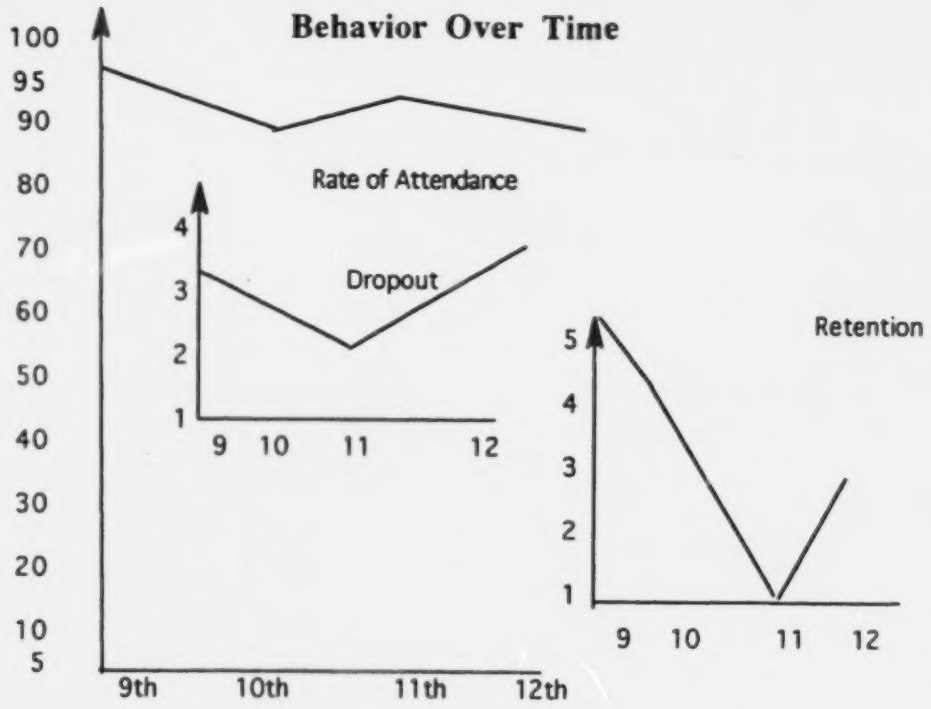
An examination of the soft, perceptive, data seems to confirm what the hard data is saying: Almost 45% of the the students felt there was no clearly defined curriculum at the school, 43% did not identify the teaching strategies as effective, and 57% said there was no organized homework policy.

Something more serious is wrong at the school and needs to be examined.

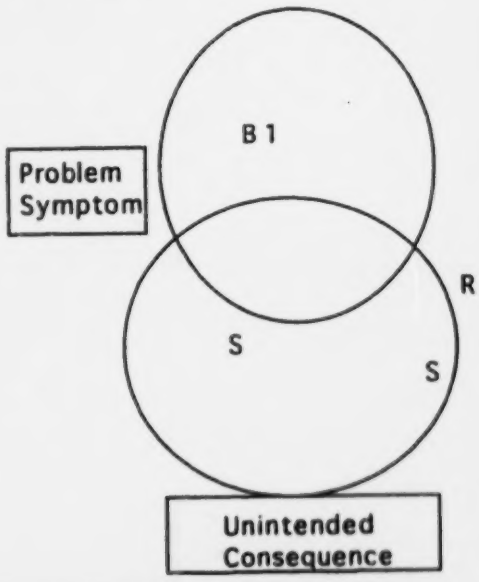


Loop Construction





Retention rates are high at 9th and 10th grades with lower dropout and retention rates at grade 11. Attendance is second only to 9th grade. Both retention and drop-out rates are higher at 12th grade level. The number of absences is also higher.



Archetype

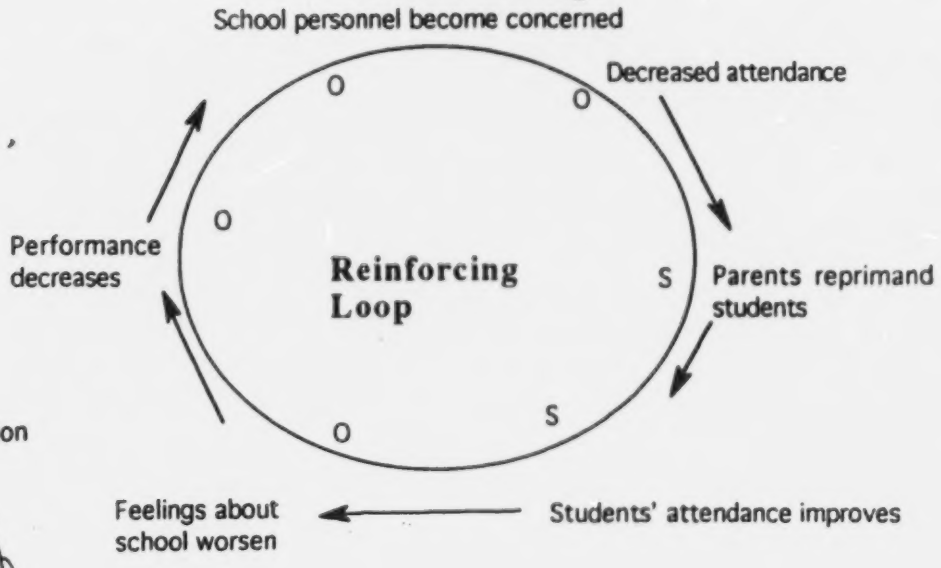
Fixes That Fail

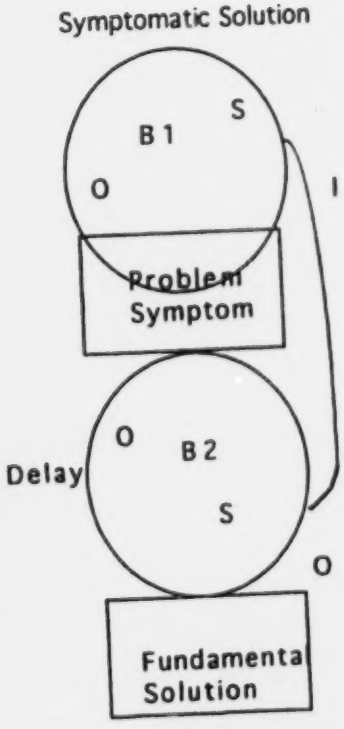
Problem Statement: KIRIS data shows 12th grade as having the most consistent attendance weakness

Activities: Continue to phone parents of absent students to express concern

Systems Tools

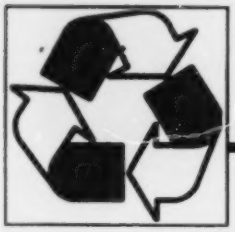
Causal Loop





Archetype

Shifting the Burden



Find the Archetypes in the Story

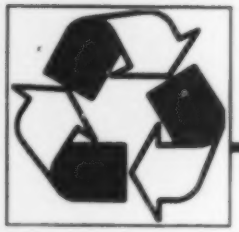
Market Middle School found its enrollment in its parent organization declining. The school still enjoyed one of the best reputations for "strong academics and curriculum" in the school district, but inthe last year, the school has been involved in several reorganizing efforts within the school. Notices for meetings went out late; sometimes, the meetings were cancelled altogether. When meetings did occur, only a few of the faculty members attended. Parents began to feel that the school was no longer interested in their involvement and support. When comments were made by some of the parents, administrators at the school assured them that the commitment was still there but continued as before. The parents consulted the teachers of their children but stopped attending meetings.

The Rogers High School faced a crisis situation. Their assessment scores had declined on the state testing and they needed to make improvements in the following year. They made immediate changes in their scheduling, going from a six period day to an eight period day in order to expose the students to more course offerings. The school which has had a "family" atmosphere changed almost immediately. Faculty were not able to spend much time with students on a one-to-one basis as they had before. The school had a real commitment to each student. Administrators and teachers kept assuring students as soon as the test scores were up, that things would return to normal. Discipline problems began to occur in the high school in a way that they had not before. Several students were expelled for fighting at sports functions.

John Roberts had been teaching for ten years before he took an additional job outside teaching. He had always wanted to be a teacher, but he wanted additional income in order to rennovate his home. He often worked late at night and on weekends. His colleagues commented on the fact that he often seemed tired and drained. His principal commented on the fact that he was late with his lesson plans and that he was bringing more students to the office for discipline problems. Although the grades in his classes had actually risen, the kids and even some of the parents commented that things were just not the same. In the lounge, teachers noticed that John had begun to talk about how most of his students were unmotivated.

The administrators and teachers in Fulton School District have been adversaries for a long time. They have fought for salary increases at the expense of the other group for years. The administrators argue that their raises have occurred moe frequently because they are fewer in number and it is easier to find the funds for their raises. Teachers who for years have purchased materials for their classrooms and not had a payraise are resentful of the administrators' pay increases. The conflict spills over into other areas in the school district.

A school district that does not do a great deal of long term financial or instructional planning invests heavily in the purchase of computers anticipating state revenues. Funds are borrowed to purchase equipment. State funding is delayed. The school district now has hardware but no software or funds to train teachers with. It must seek another loan to purchase these items thus insuring that it will have additional interest to pay before state funding is ever received.



Find the Archetypes in the Story

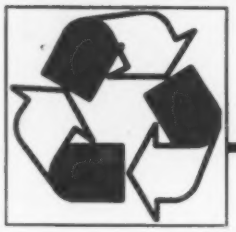
1. The faculty members of Williams High School are very divided. Many of them have taught together for some time and over the years, divisions and factions have developed. Several of the departments are at loggers-head with themselves as well as across departments as with the math, science, and p.e. departments. Performance of the school is suffering, but no one has a solution. The principal who has only been in his position for a couple of years does not want the attention that would come from bringing in an outside expert to help resolve some of the conflict. He has thought about just sitting it out and seeing if anything will develop, but he is not sure if he can do that. He doesn't believe that he can do anything to help though. Previous principals had been involved in the creation of the present tension so the staff is naturally wary of turning to him. He finally decides to bring in someone to assist.

2. Oakes Elementary School has four janitors assigned to it by the central office. Maintenance work is done by a team of workers assigned to the district. Whenever repairs are needed, a request must be filled out and sent to the central office. No equipment is kept at the schools. Oakes' annual operatng budget is small. The school is some distance from the main office so there is a time delay as far as getting repairs done, but the central office believes that the present system is more efficient in the long un.

3. Perkins Elementary has just finished a curriculum development staff development. An outside expert was brought in for three days and quickly went through a process for rewriting curriculum. Most of the teachers and staff are uncertain about how to begin the actual process of writing the curriculum, never having done it before. Coordinators from the staffwho were trained at the same time lack the expertise to assist.

The board of education in Lewis County has constructed several new schools in the past several years rather than remodeling or rennovating existing structures. In general, the school district has over-extended itself. In order to save money, it decides to postpone repairing the roofs on two of the newer schools. By spring of the next year, the buildings from want of repair have suffered extensive damage and the school system is out a great deal of money.

In order to insure better performance of its administrative staff and get more for its money, the Lewis County board of education decided to require that all employees would maintain a record in the central office of their destination and purpose of trip when they left they office. A sign-out board was posted in the central office and employees were required to enter the time and destination. The superintendent chose to interpret the directions literally and required all employees if they visited two different sites to return to the central office to sign out before they left for the second destination. By the end of two months, the district's travel budget had almost doubled and the amount of time that the staff spent in the field had dwindled considerably.



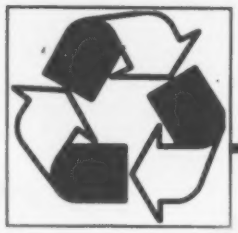
Find the Archetypes in the Story

A school system has had several years of negative publicity regarding certain issues regarding expenditures. Public confidence in the system has eroded. Feeling a need to re-establish a positive image, the superintendent hires a public relations expert who is responsible almost immediately for getting several articles favorable to the system in the local papers. He believes that the school system is on its way to better relations with the community and urges the PR person to increase the number of articles submitted each week.

During several board meetings, conflict has developed between members of the board and the superintendent over evaluation procedures used for school personnel. Tempers have flared and hostile words have been said. In response, the superintendent has suggested that the board and he shedule their retreat earlier this year and spend two days without discussing their conflict.

Despite the principal's feeling that they may not be ready, the staff of an elementary school has chosen to become an SBDM school. They elect their representatives. Most of the faculty attend the council meetings and express their desire for several changes at the school. These changes are opposed by the parents and the principal. The teachers feel that the principal is influencing the parents and blocking the changes because he opposed the council in the first place. They decide to align themseves with the parents in order to insure passage of their motions. They meet with parents and present their case and are successful.

As a result of new educational goals, a school district has decided it needs to realign its curriculum so it alls a meeting of the existing curriculum committee. These individuals have already been identified and in fact, the members have been serving for a couple of years. The local teacher association complains that there is not enough representation on the committee,and that there are several teachers who have expressed an interest in serving on the committee. She also points out that the curriculum guides that had been prepared in the past were not widely used. The instructional supervisor , however, cautions the president that the second year of the state assessment is coming up in the fall of the year and there is a real need to get the curriculum realigned as soon as possible. These committee members are experienced and from some of the schools that have done better on the threshold scores within the district. Local board members and the superintendent want the realignment process finished as soon as possible.



Find the Archetypes in the Story

The language arts department at Hayes High School has a limited budget that they use to purchase materials for the classroom and to take students on field trips with. As the member of the department designate how funding will be spent the next year, they consider some of the requests that the different classes have made throughout the course of the year. The honors classes want to visit some of the libraries and museums in the city and have asked for some enrichment readings. Impressed by the maturity of their requests, the faculty votes to give them first priority. Civic organizations in the community when they discover the studens' objectives agree to contribute also. Upon learning of this, the remedial classes are , at first, upset but then accept the fact that their requests were not quite as sophisticated. They make no requests for the following year.

Two of the students in Mrs. Lynn's 12th grade honors English class at Hayes High School have submitted pieces for the local paper and school literary magazine. Sue and Frank are the children of two of the teachers at the school. Cheryl, who is from a low-income family that has just moved to the town is reluctant about sharing her work, but has at the prompting of Mrs. Lynn also submitted an essay, but it is of a more somber nature than the other pieces sent from the class. Mrs. Lynn found the piece interesting and well-written. Cheryl's work is accepted but with less enthusiasm by the student editors. The sponsor of the literary magazine stops by to congratulate Mrs. Lynn for the work of her students. As she prepares to leave, she mentions the fact that the school can send two entries to a national magazine for consideration and asks for Mrs. Lynn's recommendation. Recalling the reaction of other students, Mrs. Lynn recommends Frank and Sue's pieces. The next day, there is an announcement about the selection over the school intercom. Cheryl is even more convinced that she should not share her work with others after the incident.

Two departments at a school (the drama and art department) believe that they are in competition for field trips, recognition, and funding at the school.

Administrators in the central office experience conflict because they are in an unannounced competition for a promotion. They attempt to prove their superiority to the superintendent.

Two strong, district recognized teachers want to be chairman of the department at the school thus creating division and tension among other staff members.

A principal of a school feels threatened by the faculty members who serve on the site-based committee, believing that they are challenging his authority with parents and other teachers.